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FOREST SURVEY RELEASE NO. 33 June 18, 1938

FOREST RESOURCES OF NORTHWEST FLORIDA

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A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

FOREST SERVICE
ALLEGHENY FOREST
EXPERIMENT STATION
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FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release is based on a field survey made June 30, 1934, to Nov. 20, 1934, and two field canvasses of forest industrial plants to determine forest drain, the last of which was completed during June 1937. It should be regarded only as a progress report since it contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds. Item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

Staff Assignment

Preparation of Report - A. R. Spillers, Associate Forest Economist
In Charge of Field Work - E. B. Faulks, Associate Forest Economist
In Charge of Computations - P. R. Wheeler, Associate Forest Economist

FOREST RESOURCES IN NORTHWEST FLORIDA

General Description

Northwest Florida is the long arm of the State that extends along the Gulf Coast south of Georgia and Alabama and includes the 16 counties west of the Aucilla River (see map, fig. 1). It is a rather sparsely settled area in which only 26 percent of the total population of 254,000 (1930 Census) live in cities of 2,500 population or larger; most of the inhabitants live on farms and in lumber or turpentine camps. Pensacola near the western boundary, with over 30,000 people, and Tallahassee near the eastern edge, with about 11,000 people, are the only cities of more than 10,000 population.

More than four-fifths of the total area of 7,287,000 acres is classed as forest (table 1), with longleaf and slash pines predominating. Although agriculture is the most important means of livelihood, many of the farmers find at least part-time employment in the various forest industries (sawmills, pulp and paper mills, other wood-products industries, and turpentine stills), which provided in all about 3 million man-days of employment in 1936.

Table 1. -- Total area classified according to land use

Land use	Area		Proportion of total area	
	Acres		Percent	
Forest:				
Productive	6,017,500		82.6	
Nonproductive	17,700		.2	
Total forest		6,035,200		82.8
Agricultural:				
In cultivation:				
Old cropland	695,700		9.5	
Newly cleared cropland	4,200		.1	
Out of cultivation:				
Idle	145,200		2.0	
Abandoned	74,300		1.0	
Improved pasture	37,200		.5	
Total agricultural		956,600		13.1
Other nonforest		295,200		4.1
Total area		7,287,000		100.0

Excellent shipping facilities, especially along the Gulf Coast, encouraged the early growth of important forest industries; and the excellent railroad and recently developed highway systems have made possible the establishment of many forest-products plants in the interior (fig. 4). The Apalachicola and the Choctawhatchee Rivers and, to a lesser extent, the Aucilla, Ochlockonee, Escambia, and Perdido, are navigable for barges; flowing southward into the Gulf, they form the principal drainage system of the unit. In general, the coastal belt is low, flat, and poorly drained, but sand and clay hill areas in the northern half have elevations up to 300 feet above sea level.

Farmers own approximately one-fifth of the area, although farmland (including farm woodlands), according to statistics provided by the Census, decreased more than 10 percent between 1910 and 1935. The Forest Survey found that about three-fourths of the total agricultural land was in cultivation, corn and cotton being the principal crops; while over 200,000 acres that had been out of cultivation for the last 2 years were classed as idle or definitely abandoned agricultural land. Acreage in improved pasture is small, chiefly because the large cattle industry depends for grazing upon the open forest and farm woodlands. A study of three counties in 1934 indicated that nearly 20 percent of the area is owned by the various forest-products industries, while about 12 percent is in public ownership — principally in the Apalachicola and the Choctawhatchee National Forests, which offer excellent examples of the possibilities of providing forest industries with a continuous supply of raw materials. The remaining area is in the possession of land speculators, banks, insurance companies, and non-residents. The study of land ownership in the above-mentioned counties revealed that the size of the average holding was about 210 acres and that 92 percent of the ownerships were small (less than 500 acres each). In 1934 almost one-third of the entire area was in tax default for 3 or more years, and in several counties more than one-half of the land was in default. Non-payment of taxes, however, does not necessarily imply abandonment of private ownership.

Description of the Forest

In this locality the predominance of pine is encouraged by an abundant rainfall, a growing season about 8 months long, and a soil composed chiefly of sandy loam or deep sand. About 44 percent of the forest area is rolling uplands; 30 percent is flatwoods; and the remaining 26 percent is in swamps, bays, ponds, and river bottoms. The longleaf-slash pine type-group, which covers over 4 million acres, or 68 percent of the forest area, is the principal type-group in the unit (table 2). The hardwood type-group, with its gums, oaks, and other southern hardwoods, covers 20 percent of the forest land, while the loblolly and the cypress types occur to only a limited extent.

The prevalence of certain forest types over large areas is shown on the map (fig. 1), although within the broad range limits there delineated occur many small intermingled areas of other types, as well as areas of cleared land. The longleaf-slash pine types are usually found on the rolling uplands or flatwoods. The loblolly pine (or "nonturpentine" pine) types are usually confined to the more fertile clay soils of the rolling hills in Jackson, Gadsden, Leon, and Jefferson Counties, while both the hardwood and the cypress types are usually confined to the larger bottomlands and swamps and to the

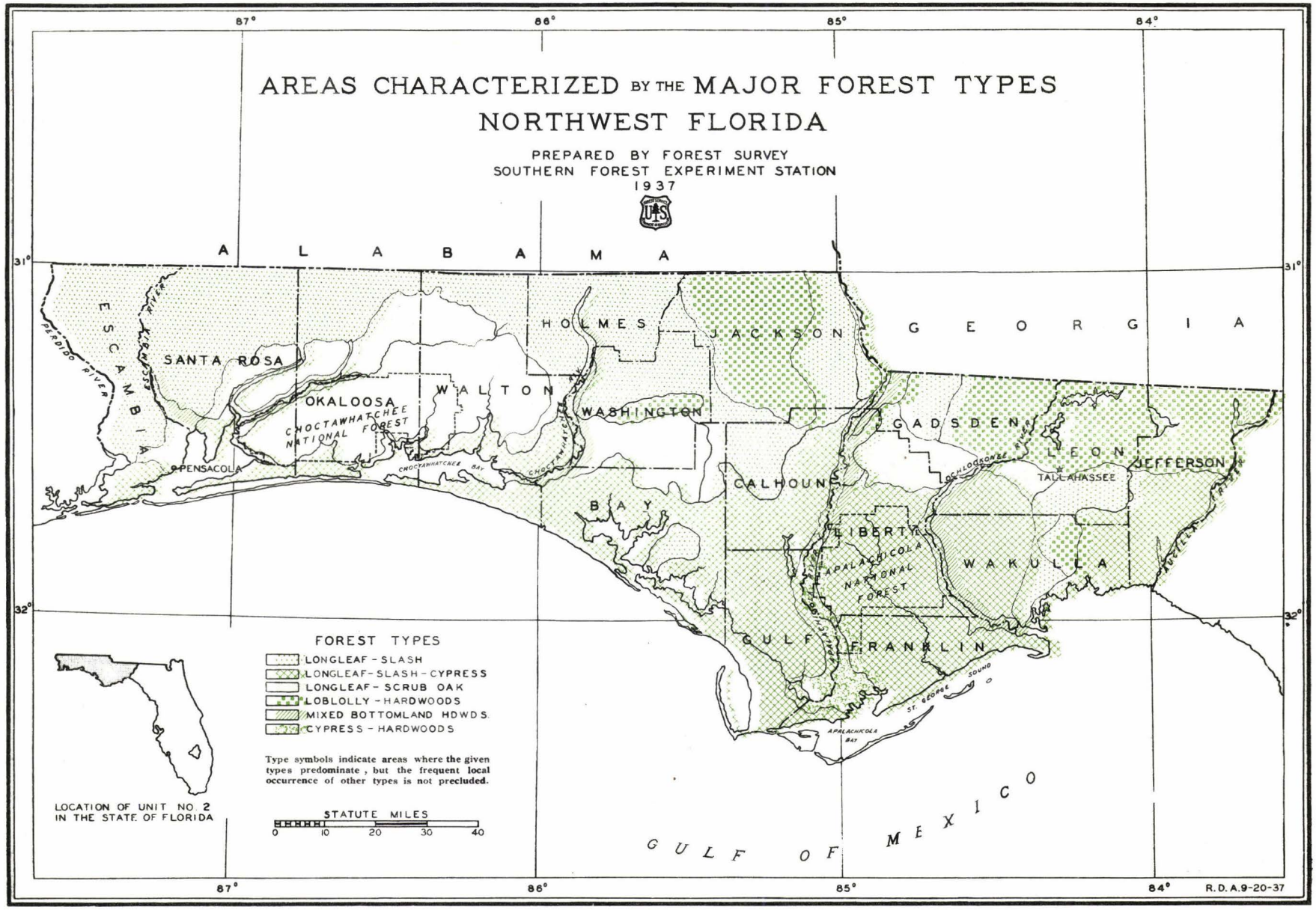
AREAS CHARACTERIZED BY THE MAJOR FOREST TYPES
NORTHWEST FLORIDA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1937
87°
86°
85°
84°
31°
32°
A L A B A M A
G E O R G I A
G U L F O F M E X I C O
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
WASHINGTON
JACKSON
CALHOUN
GADSDEN
LEON
JEFFERSON
LIBERTY
WAKULLA
FRANKLIN
GULF
BAY
PENSACOLA
TALLAHASSEE
CHOCTAWHATCHEE NATIONAL FOREST
APALACHICOLA NATIONAL FOREST
PERDIDO RIVER
CHOCTAWHATCHEE BAY
APALACHICOLA BAY
ST. GEORGE SOUND
OCHLOCKONEE RIVER
FOREST TYPES
LONGLEAF - SLASH
LONGLEAF - SLASH - CYPRESS
LONGLEAF - SCRUB OAK
LOBLOLLY - HARDWOODS
MIXED BOTTOMLAND HDWDS.
CYPRESS - HARDWOODS
Type symbols indicate areas where the given types predominate, but the frequent local occurrence of other types is not precluded.
STATUTE MILES
0 10 20 30 40
LOCATION OF UNIT NO. 2 IN THE STATE OF FLORIDA
R.D.A. 9-20-37

FIGURE 1.

"ponds" and "bays" throughout the flatwoods. The scrub oak-hardwood type, which now occupies much of the land formerly covered with longleaf, is an exception, in that it is found upon the dry, rolling, sand hills.

As may be seen in table 2, second-growth stands, which are characteristic of this Survey unit, occupy nearly 69 percent of the forest area. Old-growth stands, containing large trees that would make high-quality lumber, now occupy only 17 percent of the forest area. Old-growth stands exist mostly in small isolated patches, although a few good-sized blocks of old-growth hardwoods are found along the Apalachicola River. More than half of the old-growth area has been subjected to partial cutting that has involved the removal of 10 percent or more of the saw timber (i.e., hardwoods at least 13.0 inches d.b.h. and pines and cypress at least 9.0 inches d.b.h.) but has left per acre at least 1,000 board feet (green lumber tally) of hardwoods and cypress, or 600 board feet of pine. The uncut old-growth stands average per acre nearly 5,000 board feet, while the partly cut stands average about 3,300.

Of the second-growth stands, which are scattered throughout the area in both large and small blocks, about 22 percent by area is classified as sawlog size, having a minimum of 600 board feet per acre if uncut and 400 if partly cut. Combining uncut and partly cut stands, this forest condition contains an average volume per acre of about 2,600 board feet, or 12 cords (including under-sawlog-size material). Second-growth stands, made up chiefly of trees under sawlog size, contain an average of 200 board feet per acre, or slightly more than 2 cords, and occupy approximately 61 percent of the second-growth area. The reproduction condition, which is the youngest second-growth condition, occupies 17 percent of the second-growth area and consists chiefly of seedlings and sprouts less than 1 inch d.b.h.

The distribution of the seedlings in the natural reproduction area varies greatly. Approximately 17 percent of the area classed as longleaf pine reproduction, and 13 percent of the slash pine reproduction, are well-stocked with more than 900 well distributed seedlings per acre. Also 19 percent of the longleaf and 13 percent of the slash pine reproduction area has from 170 to 900 well distributed seedlings per acre. On approximately 7 percent of the longleaf and 8 percent of the slash pine reproduction area, however, there is a fair stand of seedlings (300 or more per acre), but they are poorly distributed, i.e., in dense groups with open spaces between. The remainder, and by far the greater part of the reproduction area, has a minimum stocking of 80 seedlings per acre (seldom more than 300), that usually are poorly distributed. Where longleaf pine stands are clear-cut on deep sandy land, scrub oaks often capture and occupy the area for many decades. On the better soils, loblolly pine is taking over large areas formerly held by longleaf pine. There is much evidence that, where the incidence of forest fires is kept to a minimum, slash pine tends to replace longleaf after cutting, if seed trees are present.

It is significant that this Survey unit has an unusually large area in the clear-cut condition. Fully 14 percent (about 877,000 acres) of the forest area has been cut so severely and thereafter burned over so frequently that natural reforestation has failed to restock it with at least 80 seedlings per acre. Of this entire area, approximately 356,000 acres have 3 or more pine seed trees at least 6 inches d.b.h. and should reforest naturally if fires are kept out; 319,000 acres have 1 or 2 pine seed trees and may

eventually reforest, if fires are controlled; while the remaining 202,000 acres are without seed trees and probably will require artificial reforestation to make them productive of desirable species. Practically all of the clear-cut area is in the longleaf-slash pine types.

Table 2. -- Forest area classified according to type-group and condition

Forest condition	Forest type-groups designated by predominant species				Total	Percent of total forest area
	Longleaf and slash pine	Loblolly and other pine	Hardwood	Cypress		
	Acres					
Old growth:						
Uncut	148,500	32,100	136,000	45,600	362,200	6.0
Partly cut	283,700	44,800	226,200	92,900	647,600	10.8
Total old growth	432,200	76,900	362,200	138,500	1,009,800	16.8
Second growth:						
Sawlog size:						
Uncut	524,300	157,900	67,600	16,000	765,800	12.7
Partly cut	70,100	47,200	10,200	1,700	129,200	2.1
Under sawlog size	1,697,000	168,100	632,400	27,000	2,524,500	42.0
Reproduction	552,300	44,700	101,300	12,600	710,900	11.8
Total second growth	2,843,700	417,900	811,500	57,300	4,130,400	68.6
Clear-cut	846,100	14,300	10,100	6,800	877,300	14.6
Total all conditions	4,122,000	509,100	1,183,800	202,600	6,017,500	100.0
Percent of total	68.5	8.5	19.6	3.4	100.0	

The productivity or site quality of the forest is indicated by the height attained by dominant trees at 50 years of age. Approximately 10 percent of the sites dominated by pine are classed as "good," growing trees 80 feet or higher in 50 years; 72 percent are "medium," as indicated by 60- and 70-feet trees; and 18 percent of the sites are "poor," under 60 feet. The proportion of good sites is about the average for the Naval Stores Belt. Good sites for loblolly are most common in the well-drained, rolling terrain in the northeastern counties, and for hardwoods in the bottomlands along the larger streams. The poor sites for turpentine pines are most prevalent in the deep sand hills of Santa Rosa, Okaloosa, Walton, and Washington Counties, and in the poorly drained areas like Tate's Hell Swamp in Franklin County.

Figure 2 shows the relative prevalence of sound trees by 2-inch diameter-classes.[1/] The striking features brought out by these diagrams are (1) the comparative shortage of trees in the larger diameter-classes from which commodities of high value are produced, and (2) the large number of 2-inch trees. It should be appreciated that the latter class is a highly perishable one and will be reduced through the effects of fire, overcrowding, and the other causes of mortality. Improvement and extension of fire protection, however, will reduce the mortality in this and other small size-classes and insure an eventual increase of the stocking in the larger diameter-classes.

In order to judge the adequacy of the present forest from the standpoint of ideal sustained-yield management, its age-class and volume distribution has been compared in figure 3 with that of a managed forest under an assumed rotation of 70 years, which is the period conceivably needed to produce lumber, poles, naval stores, and pulpwood as an integrated crop. The volume figures used are cubic foot, inside bark; no deductions for woods cull (which would be negligible in a managed forest) have been made, and as an equalizing factor, no volumes in turpentined butts have been included. The ideal forest is shown divided into 7 equal areas, each containing one 10-year age-class; and the per-acre volumes used are based on the most heavily stocked 10 percent of the present forest stands for weighted average sites in the turpentine pine types. The area and volume per acre of the present forest is diagramed from field estimates of the age-classes of the 4,122,000 acres in the turpentine pine types.

The above comparison discloses two principal deficiencies in the composition of the present stand: (1) The distribution of age-classes by area is far from ideal in that too large a proportion is in the younger age-classes; and (2) the present forest is sadly deficient in stocking, as shown by the fact that the volume per acre in cubic feet in the present stands averages somewhat less than a third of the volume attainable under management, while the volume in the present 0- to 10-year class is largely in residual trees. For instance, instead of the ideal one-seventh of the area being in the 0- to 10-year class, the area occupied by this age-class, about three-fifths of which has failed to restock, is nearly $2\frac{1}{2}$ times this. Also about one-seventh of the forest area is occupied by stands more than 70 years old. Only one of the present age-class areas, viz., that occupied by stands 21 to 30 years old, approximates the ideal requirement as to area.

1/ The 2-inch class ranges from 1.0 to 2.9 inches d.b.h., the 4-inch from 3.0 to 4.9 inches, and so on.

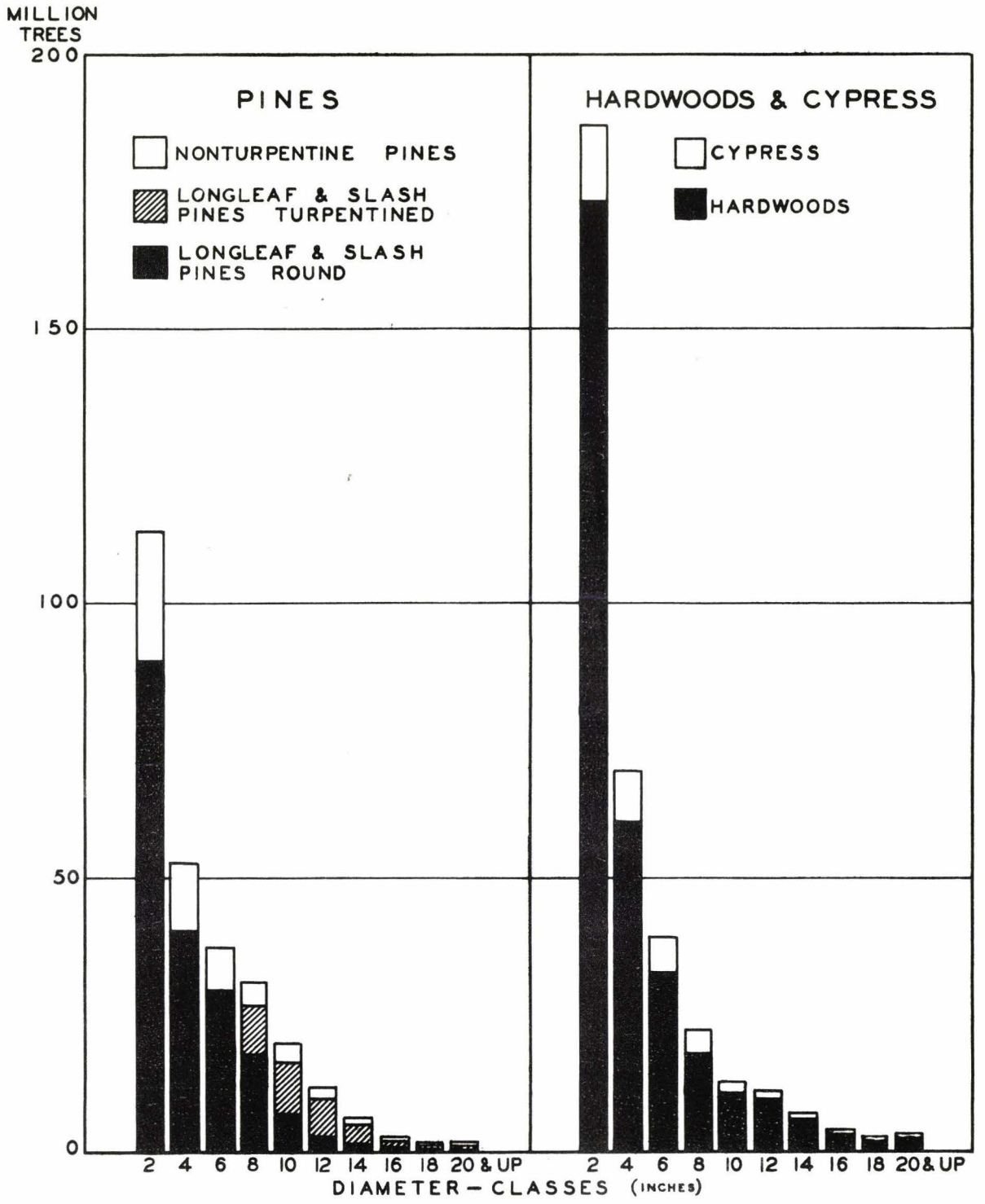

FIGURE 2.- STAND DIAGRAMS

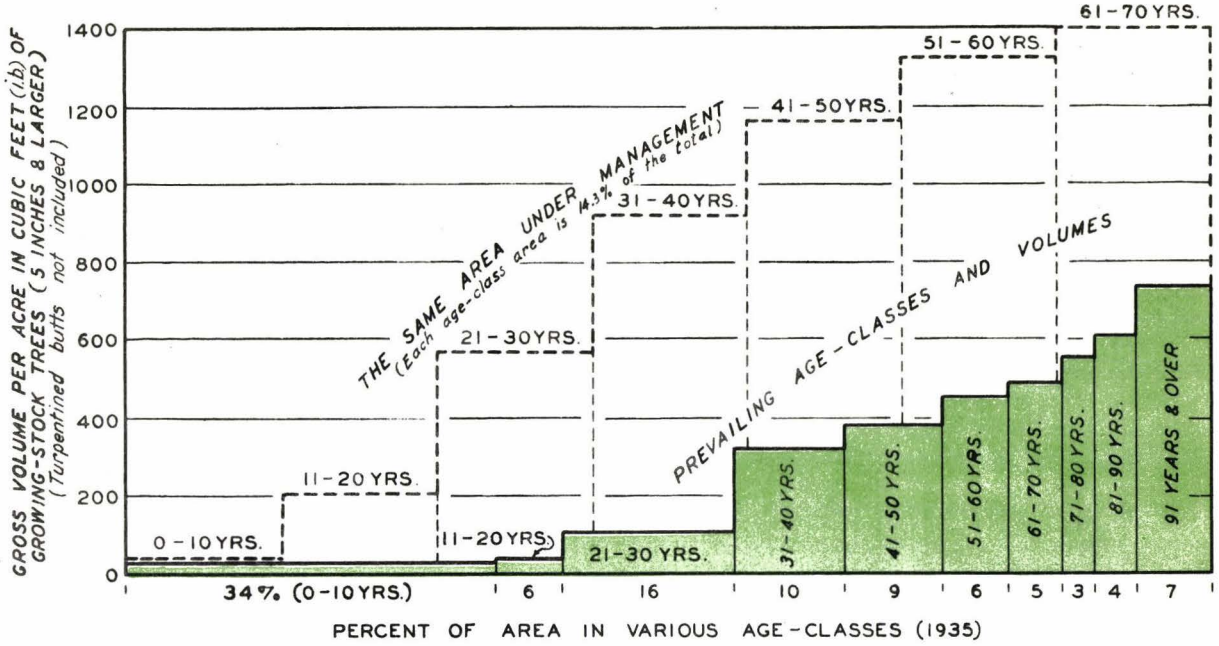

FIGURE 3.- **PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THAT ON THE SAME AREA UNDER MANAGEMENT** (Based on turpentine-pine type area of 4,122,000 acres)

Naval Stores Industry and Resources

The importance of the naval stores industry in northwest Florida is indicated by the fact that it produces approximately one-tenth of the naval stores of the South and provides annually almost one million man-days of employment — approximately one-third of the total employment in all forest industries. Up until about 1915, the industry was entirely dependent upon gum from living trees, but now wood distillation for the primary purpose of naval stores production is of growing importance. Also in the future an increasing quantity of naval stores may be recovered as a byproduct in the sulphate process of manufacturing paper pulp from pine.

Gum Naval Stores Industry 2/

In the season of 1933-34 (year beginning March 1), northwest Florida produced from the gum of living trees some 39,000 naval stores "units" 3/ valued roughly at $2,000,000. During the season of 1934-35 about 1,339

2/ For additional information see "Statistics on gum naval stores production," Forest Survey Release #17, Dec. 31, 1935, Southern For. Exp. Sta., New Orleans, La. Also Gamble's International Naval Stores Year Book for 1937-38, "Gum naval stores operations of 1934-35 — Their size and distribution and the employment provided by them," by Harry F. Smith and Elsa M. Rayl, Southern For. Exp. Sta.

3/ A unit is made up of one 50-gallon barrel of turpentine and three and one-third 500-pound (gross) barrels of rosin.

"crops"of 10,000 cups each were in operation. Approximately 110 processors or distillers of gum, together with about 400 gum producers without stills were engaged in the work, and 876,000 man-days of employment were provided. The naval stores production for the season of 1936-37 is estimated to be slightly less than 37,000 units. The stills are fairly well distributed over the entire survey unit as shown in figure 4.

Gum Naval Stores Resources

The territory considered as suitable for gum naval stores operations is almost $4\frac{1}{2}$ million acres and includes practically all of the area of the longleaf-slash pine type-group and a fraction of the others. The broad classification of "turpentine area" includes forest that is used or that may be used for commercial operations, together with the coincident patches of clear-cut areas and of loblolly pine and hardwood forest. Approximately 47 percent of this area is in the rolling uplands; 37 percent is in the flatwoods; and the remaining 16 percent is in swamps, bays, and river bottoms.

The turpentine area is classified as "round timber," "working," "resting," or "worked out." "Round timber" areas are made up almost entirely of unturpentined longleaf and slash pine stands ranging from reproduction to old growth. "Working" areas, which have trees that are being chipped, are further classified as (a) "front-faced," if most of the trees are cupped for their first set of faces, or (b) "back-faced," if a significant proportion has a second set of faces. "Resting" areas have been worked but exhibit sufficient opportunities for a second set of faces on worked trees, and for a first set of faces on round trees, to justify another operation. In "worked-out" areas the turpentining possibilities of the present stands have been exhausted, and not until an adequate number of round trees has grown can working be resumed.

It is the usual custom to work front faces for about 6 years, when the cups are removed and the faces abandoned. Following a rest period of about 2 years, new faces (i.e., back faces) are started, and when these faces have been worked as long as possible the trees are usually abandoned, although a third face sometimes is possible. In working old-growth trees that are soon to be cut for lumber, it is often the practice to work the tree only 2 or 3 years prior to cutting.

On the turpentine area there were over 216 million longleaf and slash pine trees (table 3), of which about four-fifths were round (unworked) trees from 1.0 to 8.9 inches d.b.h. and represented the supply for future cuppage. Of immediate importance is the fact that there were almost as many round trees of cupping size (9 inches d.b.h. and larger) as working trees.

Table 3. -- Round, working, resting, and worked-out longleaf and slash pine trees on turpentine areas of varying history, during the season 1934-35

Turpentine-area history	Round trees		Working trees	Resting trees	Worked-out trees	Total
	1.0-8.9 inches	9 inches and over				
	M trees					
Round-timber area	93,602	9,709	-	699	247	104,257
Working area:						
Front-faced area	13,273	135	3,553	51	34	17,046
Back-faced area	26,234	277	8,528	511	1,718	37,268
Resting and worked-out area	41,905	1,824	-	9,156	5,122	58,007
Total turpentine area	175,014	11,945	12,081	10,417	7,121	216,578
Percent of total	80.8	5.5	5.6	4.8	3.3	100.0

The gross round-timber area is about 2 million acres; the working timber area, about 1 million acres; and the combined worked-out and resting areas about 1½ million acres. Figure 5 shows graphically the condition of the turpentine area of 4½ million acres. Of the total turpentine area (bar D), 28 percent is in "well-developed" turpentine stands, i.e., stands with at least 8 future faces per acre on round, resting, or working trees 9.0 inches d.b.h. or larger (they average, as a matter of fact, 19 possible faces per acre, and have many small trees); about 10 percent is in advanced sapling stands, which have a sufficient number of round trees approximately 8 inches in diameter to indicate that the stands will reach the well-developed stage within the next 8 years; 19 percent is in stands that will reach this stage after 8 years and within 20 years, being made up mainly of 2-, 4-, and 6-inch trees; 39 percent is in reproduction, clear-cut, and seed-tree areas that will require over 20 years; and 4 percent is in intermingled non-turpentine areas.

Round-timber area

A few inaccessible areas, usually within the larger swamps and making up a small part of the total, are included in the gross round-timber area of 2 million acres. Also, there are some very small scattered bodies in the more thickly settled agricultural parts of the Survey unit which probably cannot be united into contiguous operations. There is a growing tendency, however, for farmers to work scattered small stands that produce as little as 1 or 2 barrels of gum per month. The preference of turpentine operators for flatwoods timber instead of for timber in the rolling uplands where the forest is broken by agricultural land, or for timber in the swamps, bays, etc. where some of the stands are inaccessible, is indicated by the fact that only one-third of the flatwoods turpentine area is left round while over one-half of that in the latter situations is thus left.

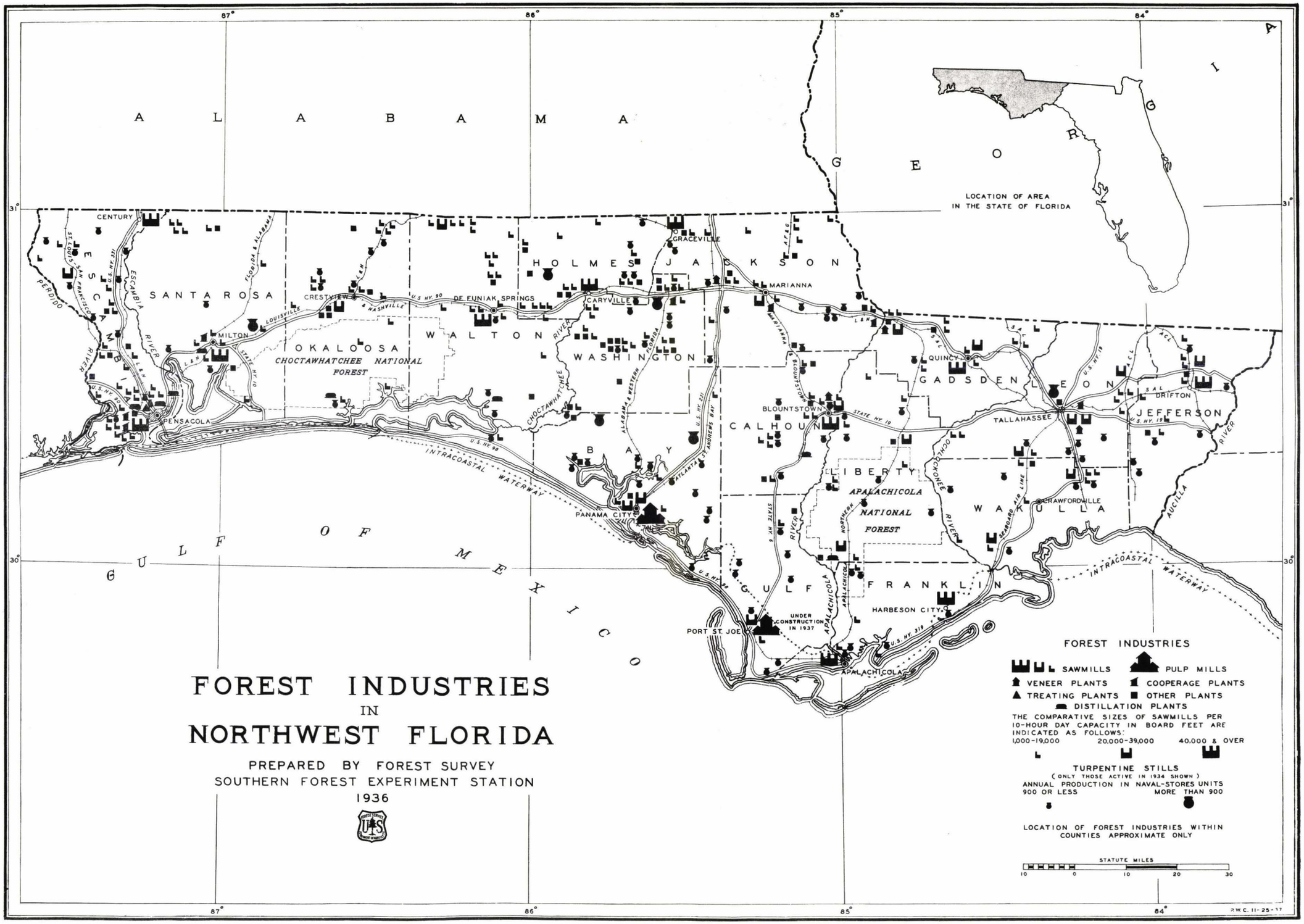
ALABAMA
GEORGIA
GULF OF MEXICO
LOCATION OF AREA IN THE STATE OF FLORIDA
87°
86°
85°
84°
31°
30°
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
WASHINGTON
JACKSON
CALHOUN
LIBERTY
GADSDEN
LEON
JEFFERSON
WAKULLA
FRANKLIN
CENTURY
PENSACOLA
MILTON
CRESTVIEW
DE FUNIAK SPRINGS
CARYVILLE
GRACEVILLE
MARIANNA
QUINCY
TALLAHASSEE
DRIFTON
BLOUNTSTOWN
CRAWFORDVILLE
PANAMA CITY
PORT ST. JOE
APALACHICOLA
HARBESON CITY
CHOCTAWHATCHEE NATIONAL FOREST
APALACHICOLA NATIONAL FOREST
UNDER CONSTRUCTION IN 1937
INTRACOASTAL WATERWAY
ESCAMBIA RIVER
PERDIDO RIVER
CHOCTAWHATCHEE RIVER
APALACHICOLA RIVER
OCHLOCKONEE RIVER
AUCILLA RIVER
FOREST INDUSTRIES
SAWMILLS
PULP MILLS
VENEER PLANTS
COOPERAGE PLANTS
TREATING PLANTS
OTHER PLANTS
DISTILLATION PLANTS
THE COMPARATIVE SIZES OF SAWMILLS PER 10-HOUR DAY CAPACITY IN BOARD FEET ARE INDICATED AS FOLLOWS:
1,000-19,000
20,000-39,000
40,000 & OVER
TURPENTINE STILLS
(ONLY THOSE ACTIVE IN 1934 SHOWN)
ANNUAL PRODUCTION IN NAVAL-STORES UNITS
900 OR LESS
MORE THAN 900
LOCATION OF FOREST INDUSTRIES WITHIN COUNTIES APPROXIMATE ONLY
STATUTE MILES
10 0 10 20 30
FOREST INDUSTRIES
IN
NORTHWEST FLORIDA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1936
P.W.C. 11-25-37

FIGURE 4.

Approximately 21 percent of the round-timber area was well developed and probably ready for immediate working (fig. 5, bar A), with an average stand per acre of 19 round trees at least 9.0 inches d.b.h. and 11 trees between 7.0 and 8.9 inches d.b.h. In addition, it is estimated that about 37 percent of the round-timber area will be well-developed with about this same density within 8 to 20 years, but about 38 percent will not reach turpentine size within 20 years, for it is made up of reproduction stands and clear-cut areas. Nonturpentine forest types cover 4 percent of the gross round-timber area.

Working turpentine area

While the gross working turpentine area was almost a million acres, only two-thirds of it had cups. About 373,200 acres averaged more than 12 cups per acre; 116,500 acres, 8 cups; and 119,000 acres, 4 cups per acre; while the remainder had no cups, being made up largely of small sapling, reproduction, and clear-cut areas, as well as nonturpentine pine forests. In the season of 1934-35, on 12,081,000 trees were 13,394,000 cups, approximately one-third of which were first-year or "virgin" cups hung in 1934 (table 4). In number of new cups hung, the season of 1934-35 showed an increase of about 60 percent over that of 1933-34 and about 350 percent over that of 1932-33, after allowance was made for annual mortality.

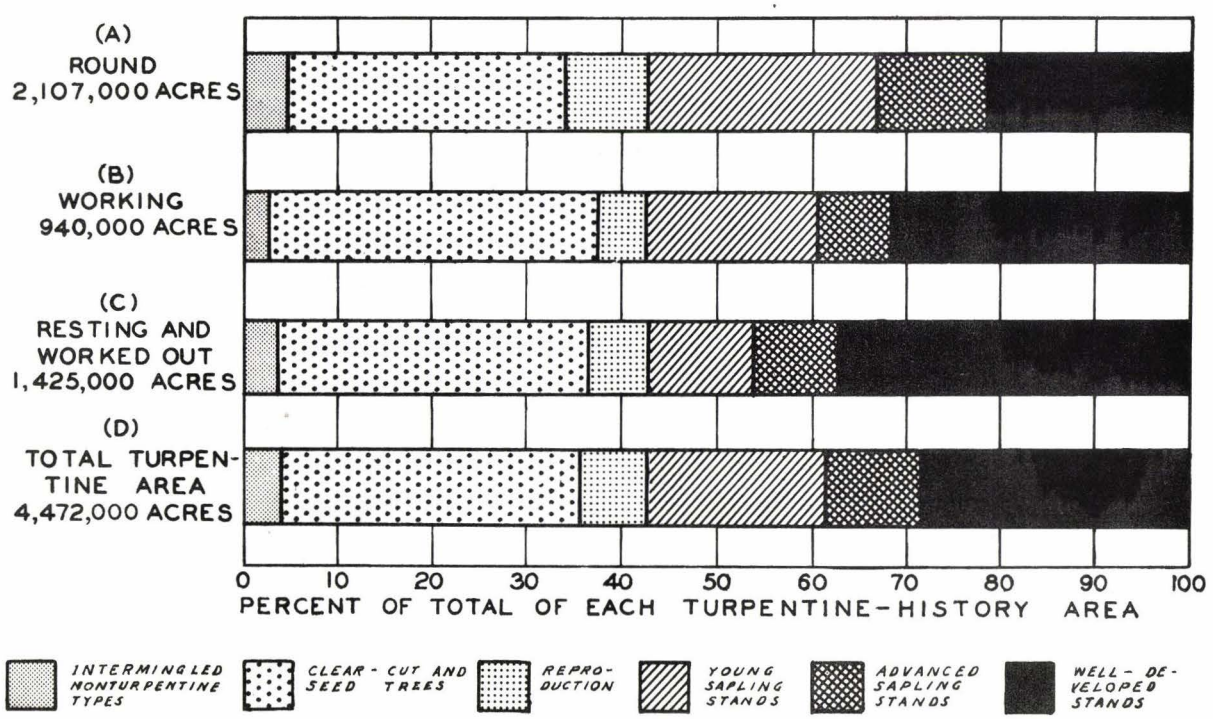

FIGURE 5 - CONDITION OF THE TURPENTINE AREA

Although studies have shown that trees less than 9 inches d.b.h. yield such small quantities of gum that they usually cannot be worked economically, the survey of working crops in 1934 showed that about 30 percent of the working trees were below this size. At the beginning of the 1934-35 season, cups were hung on 48 percent of the 8-inch round trees in the area of newly cupped trees; on 83 percent of the 10-inch trees; and on nearly 100 percent of the larger round trees. Approximately 19 percent of the front-faced trees carried two cups.

Table 4. -- Turpentine cups hung on front and back faces, classified by year of working in the season of 1934-35

Year of working	Cups on front faces	Cups on back faces	Total	Percent
		Thousand cups		
1st year	2,313	2,203	4,516	33.7
2nd year	1,645	1,124	2,769	20.7
3rd year	428	531	959	7.2
4th year	447	1,123	1,570	11.7
5th year	701	920	1,621	12.1
6th year & up	1,086	873	1,959	14.6
Total	6,620	6,774	13,394	100.0
Percent of total	49.4	50.6	100.0	

On approximately 31 percent of the gross working area (fig. 5, bar B) there are sufficient future faces to justify continued working immediately after the present faces are worked out. This part of the working area has per acre an average of 18 future faces on trees which are now working or have been worked, and over 8 round trees 7 inches d.b.h. and larger that will soon become large enough to work, as well as a large number of smaller trees. It is estimated that after a wait of 8 to 20 years an additional 26 percent of this area will be ready for working again. About 40 percent of the gross working area, however, will not support new operations within 20 years after present faces are abandoned, and 3 percent of the area is in nonturpentine forest.

Resting and worked-out area

In the field work, "resting" and "worked-out" areas, which were grouped together, were found on almost 1½ million acres (fig. 5, bar C). Thirty-seven percent of this area is well-developed, having per acre an average of 16 future faces and 10 round trees 7 inches d.b.h. and larger. It is also estimated that 20 percent of the resting and worked-out area will reach the well-developed stage within 20 years, and that 40 percent will require more than 20 years, while 3 percent is nonturpentine-forest area. Retarding the growth of young trees upon this area are some 5 million worked-out trees, which it will be highly desirable to cut and utilize for lumber, pulpwood,

or other wood products in order to facilitate reproduction and to release round trees for faster growth.

Future Outlook for Gum Naval Stores

Inasmuch as the naval stores industry has long been active throughout this Survey unit, it is logical to assume that most of the turpentine pines, with the exception of a relatively small number in swampy, inaccessible areas and in reserves, or scattered in the agricultural sections, will be worked prior to cutting.

As stated in the preceding discussion of working area, 48 percent of the round trees in the 8-inch diameter-class were cupped in the virgin crops of 1934. It is believed that the efforts of the industry, instigated by the A.A.A. Naval Stores Conservation Program, to reduce the proportion of cupping in undersized trees, will be successful and that the practice of cupping trees under 9 inches will be changed gradually. For the purpose of analysis it is assumed that in actual practice one-third of the trees in the 8-inch class will continue to be used. In figure 6, the total number of round and resting trees on the various turpentine areas shown previously (fig. 5) is analyzed for each of three 8-year turpentine cycles. The supply for the first period, 1935 to 1942, standing in the $1\frac{1}{4}$ million acres of "well-developed" areas (in black in fig. 5) is estimated to be 3,714,000 trees annually. The supply for the second cycle, 1943 to 1950, which will come partly from round trees in the advanced sapling stands and partly from trees that were front-faced in the first cycle, will approximate 3,600,000 trees annually. In the third cycle, 1951 to 1958, the indications are that the round trees that have grown to working size on the areas now shown as young sapling stands (fig. 5), plus the round and resting trees then available in the areas previously worked, will amount to 5 million trees annually.

These figures of periodic supply may be compared with the average annual demand of 1,146,000 new cups from round trees and 1,202,000 new cups on resting trees, a total of 2,348,000 cups for turpentining alone (shown by arrow in fig. 6) for the 6 seasons beginning with 1929-30 and ending with 1934-35. These calculations of possible future yield of turpentine trees for the naval stores industry are based upon the assumption that in each 8-year period the total available supply will be used. If the total supply is not used, the unworked trees would be carried over to accumulate for working in later periods. If more than the indicated yield is cupped or otherwise utilized, it will be at the expense of later yields.

The present and estimated future stands of slash and longleaf pines must supply not only the naval stores industry but also the wood-products industry. In 1936 an industry survey showed that more than 1 million round slash and longleaf pine trees 7 inches d.b.h. and larger were cut for wood products before they were worked for turpentine (table 5). If the cutting of round turpentine trees for pulpwood and low-grade lumber continues, obviously it will reduce both the present and the future supply for the naval stores industry. Therefore, if the naval stores industry is to be maintained at the full possibility of the growing stock, the demands of the wood-products industries for longleaf and slash pines must be confined as nearly as possible to worked-out trees.

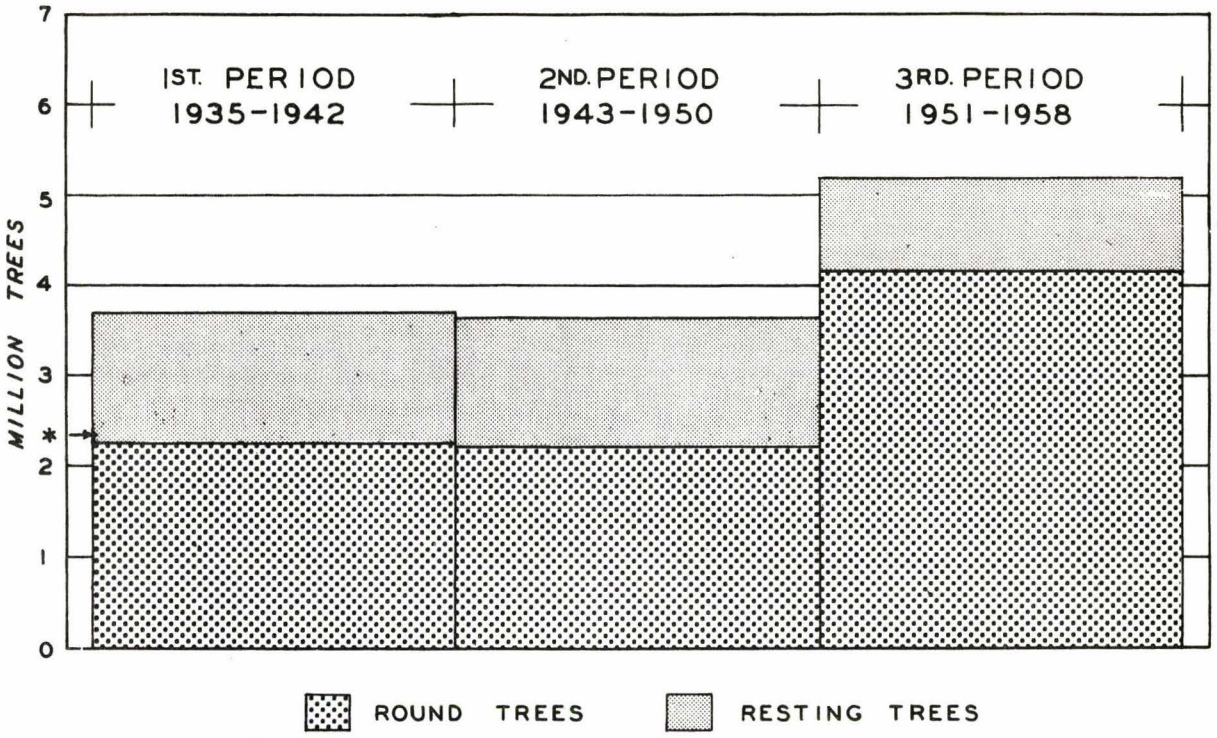

FIGURE 6 - ROUND AND RESTING TURPENTINE PINES THAT MAY BE READY FOR WORKING ANNUALLY.

*The arrow shows the level of average annual demand between 1929 and 1934 for naval stores cups on round and resting trees.

For several years naval stores factors and various forestry agencies have been encouraging the adoption of a 9-inch minimum-diameter limit. An analysis of the future supply of turpentine pines, if only those trees 9 inches d.b.h. and larger were cupped, indicates that for the first 8-year period there would be an annual possibility of 3,183,000 trees of this size (1,717,000 round and 1,466,000 resting); for the second 8-year period, 11 percent less than for the first period; and for the third period, 22 percent more than for the first. It is noteworthy that in 1936 the wood-products industries reduced the supply of round trees at least 9 inches d.b.h. more than half a million.

Table 5. -- Net change in number of round trees 7 inches and up and 9 inches and up between January 1, 1934 and January 1, 1937 in the turpentine area

	1934		1935		1936	
	7 inches and up	9 inches and up	7 inches and up	9 inches and up	7 inches and up	9 inches and up
	Thousand trees					
Round trees as of January 1	29,561	12,172	29,105	11,945	30,142	12,648
Increase due to growth of smaller trees	2,944	1,739	2,944	1,739	2,944	1,739
Decrease due to mortality	610	253	632	268	656	284
Net increase	2,334	1,486	2,312	1,471	2,288	1,455
Trees turpentined	2,050	1,241	443	268	314	190
Trees cut for products	740	472	832	500	1,013	582
Total industrial drain	2,790	1,713	1,275	768	1,327	772
	Decrease	Decrease	Increase	Increase	Increase	Increase
Net change during year	456	227	1,037	703	961	683
Round trees end of year	29,105	11,945	30,142	12,648	31,103	13,331
Percent of number on January 1, 1934	98.5	98.1	102.0	103.9	105.2	109.5

If there is no marked increase in the cutting of trees before they are worked for turpentine, there will be sufficient round timber in well-developed stands to maintain the gum naval stores industry at its present level during the next 15 years. The relatively large proportion of longleaf and slash pine trees now in the 2-, 4-, and 6-inch diameter-classes — sizes in which mortality can be reduced through better management — gives a good prospect that the gum-production level can be raised after that period through the growth of more of these trees to working sizes. The needs of both the naval-stores and wood-products industries should be so integrated and their operations so synchronized that both industries can operate satisfactorily. Since the income from naval stores to the owners of longleaf and slash pines is normally large and since the industry ranks high in economic importance in the region where it is found, it is imperative that both its present and future supply of timber be protected.

Wood Naval Stores Industry and Resources

Eight wood-distillation plants located in northwest Florida produce rosin, turpentine, pine oils, charcoal, and other products from "lightwood" — the seasoned stumps and heartwood of dead, old-growth, longleaf trees.[4/] One installation uses the steam-solvent process, while the remainder use destructive distillation, with charcoal as a residual byproduct. Approximately 230,000 man-days of employment were provided in 1936, and 166,000 tons of "lightwood" (138,000 tons of stumps and 28,000 tons of topwood), most of which came from this Survey unit, were consumed, yielding about 120,000 barrels (500 lbs. gross) of rosin and 22,000 barrels (50 gal.) of turpentine.

Seasoned, old-growth, longleaf pine stumps, at least 8 inches high, and in sufficient density to warrant extraction, were found upon 1,774,000 acres, or 29 percent of the forest area (table 6). The Survey made no effort to estimate the amount of seasoned topwood.

Table 6. -- Stand of merchantable stumps (blasting basis)

Stumps per acre	Area	Topographic situation		Total	Portion of total
		Flatwoods[1/]	Rolling uplands		
	Acres	- - - - - - Thousand tons - - - - -			Percent
5 or less	534,500	105	109	214	4.1
6 to 13	520,300	478	563	1,041	19.8
14 to 25	399,400	784	814	1,598	30.4
26 and over	320,100	1,248	1,152	2,400	45.7
Total	1,774,300	2,615	2,638	5,253	100.0

1/ Includes a small percentage of the area in swamps and bays.

On a blasting basis (5 stumps per ton of wood), it is estimated that this area has about 3,998,000 tons of stumpwood on the 719,500 acres that contain at least 2.8 tons of stumps per acre. This resource is approximately equally divided between flatwoods and rolling uplands. Clear-cut and reproduction forest conditions together contain 46 percent of the tonnage; while a large proportion of the remainder is found under thinly stocked second-growth sapling stands under sawlog size. In addition to the present matured stumps shown in table 6, there is a potential supply of 4,502,000 tons in unseasoned stumps and in stumps in densely stocked stands where pulling operations are considered impracticable and blasting undesirable. Pulling operations are usually practical only in the flatwoods and where used would increase the recovery approximately 65 percent. Additional stumps will be added to the supply as the present old-growth longleaf pine stands are logged and their stumps are allowed to season (generally for about 10 years).

4/ See: "Longleaf pine stumpwood supply in four Southeastern Survey Units," Forest Survey Release #20, Aug. 29, 1936, Southern For. Exp. Sta., New Orleans, La.

The manufacture of wood naval stores, which for rosin already amounts to almost one-half of the total production of the Survey unit, could be greatly increased if the raw-material resource were the only limiting factor. The recovery of rosin as a byproduct in the manufacture of kraft paper pulp also shows possibilities of adding greatly to the future supply. Prices for naval stores and the keen competition of substitute materials, however, do not encourage any appreciable increase in production from any source.

Inventory Estimates

Sawtimber Volumes

The total net sawtimber volume is more than 4 billion board feet, according to the Doyle rule (the rule in general use in the South), or nearly 7 billion board feet, according to the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally. The volumes in the important sawtimber species are shown in table 7. It is interesting to note (table 8) that 23 percent of the total sawtimber volume is in longleaf and slash pine trees that have been worked for turpentine.

Living pine and cypress trees at least 9 inches d.b.h., and hardwoods at least 13 inches, are classified as sawtimber trees if they contain one sound butt log 12 feet or more in length, or if 50 percent of their gross volume is in sound material. The usable portions of turpentined butts, as established by common practice, are included in the estimates. All figures are net, a deduction having been made for both woods and mill cull, that is, portions of the tree which cannot be manufactured into lumber on account of fire scars, rot, crooks, bad knots, or other defects.

Practically all of the sawtimber volume is physically accessible with the present mobile logging equipment and the excellent modern transportation facilities, as indicated by the fact that 94 percent of the forest area has been logged over at least once. In this section, although stands as light as 400 feet per acre are now commonly logged, sawtimber stands range from a minimum of 400 board feet per acre to 8,000 or more, with an average of 3,300 per acre.

Table 8 shows that old-growth forest stands, all types combined, contain 57 percent of the total sawtimber volume; second-growth sawlog-size stands, 34 percent; and all other conditions, 9 percent.

Figure 7 indicates the proportional area and volume per acre of the sawlog-size stands in the longleaf and slash pine types. The proportions shown are based upon gross volumes; no deductions have been made for woods cull, but as an equalizing factor, no volumes in turpentined butts have been included. While there is room for error in the lowest volume-per-acre class because the estimates are based on 1/4-acre plots, the combined data in the first two classes are highly significant. Stands in the turpentine pine type-group that have less than 2,000 feet per acre make up 57 percent of the type-group area, but have only 27 percent of the sawtimber; in other words, 43 percent of the type-group area contains 2,000 feet or more of sawtimber per acre and 73 percent of the type-group volume.

Table 7. -- Net board-foot volume expressed in Doyle scale and in green lumber tally based on International ¼-inch rule

Species	Doyle scale	Green lumber tally	Species	Doyle scale	Green lumber tally
	-- M board feet --			-- M board feet ---	
Pines:			Hardwoods:		
Longleaf	769,100	1,528,800	Red gum	278,700	362,400
Slash	686,900	1,253,200	Black gum	502,400	739,200
Loblolly	605,700	959,800	Red oaks	320,600	423,000
Other	130,900	240,800	White oaks	92,200	120,200
			Other hardwoods 1/	426,900	617,000
Total pine	2,192,600	3,982,600			
			Total hardwoods	1,620,800	2,261,800
Cypress	379,100	623,500			
			Total all species	4,192,500	6,867,900

1/ Principally bay, white ash, maples, magnolia, and yellow poplar.

Table 8. -- Net board-foot volume (green lumber tally, based on Int. ¼-inch kerf rule) by forest conditions

Species-group	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog-size 1/		
	---------- Thousand board feet ----------					
Pines:						
Longleaf and slash:						
Round	307,300	254,400	482,400	141,300	1,185,400	17.3
Worked	276,400	397,600	629,300	293,300	1,596,600	23.2
Loblolly and other	186,200	146,100	801,300	67,000	1,200,600	17.5
Total pines	769,900	798,100	1,913,000	501,600	3,982,600	58.0
Hardwoods	807,700	1,066,500	310,100	77,500	2,261,800	32.9
Cypress	225,900	277,200	92,400	28,000	623,500	9.1
Total all species	1,803,500	2,141,800	2,315,500	607,100	6,867,900	100.0

1/ Including a small amount in the reproduction and clear-cut conditions.

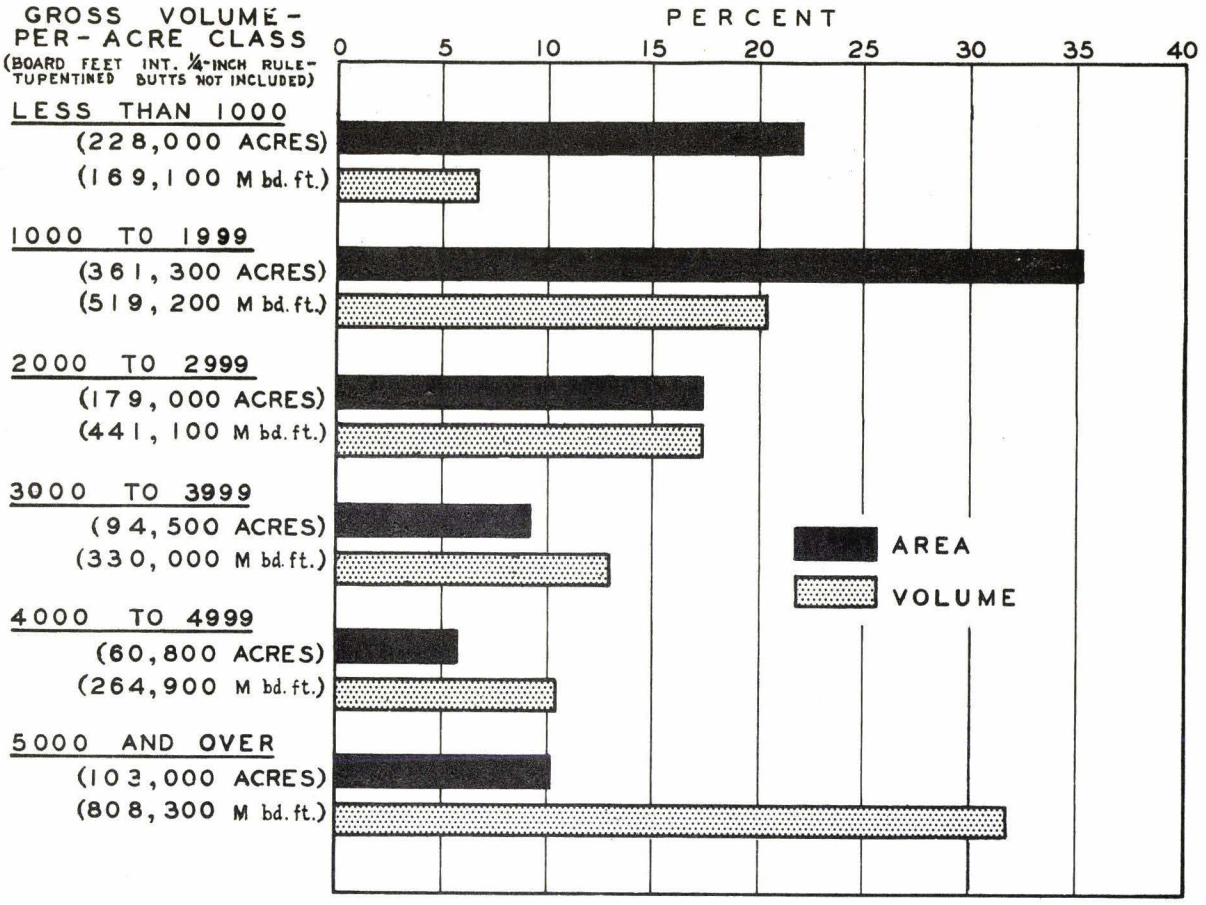

FIGURE 7 — PROPORTIONAL AREA AND VOLUME OF THE SAW-LOG-SIZE CONDITIONS IN THE TURPENTINE PINE TYPES, CLASSIFIED ACCORDING TO VOLUME OF SAWTIMBER PER ACRE

More than three-fourths of the pine volume is in trees 9.0 to 16.9 inches d.b.h. Most of this timber, which is in second-growth forests, is generally converted into lumber, poles, cross ties, staves, and pulpwood. The remaining volume is in larger trees, which occur either in old-growth stands or as scattered residuals in younger stands. These trees are used for high-grade lumber, veneer bolts, poles, and piles.

Of the hardwood volume, less than 8 percent is in trees 29.0 inches and larger, i.e., where much of the quality material is found. Thirty-three percent of the volume is in trees 19.0 to 28.9 inches d.b.h., and 59 percent is in trees 13.0 to 18.9 inches. Cypress trees 17.0 inches in diameter and larger — the sizes from which high-grade lumber is manufactured — have 44 percent of the total cypress sawtimber volume.

The cull factors used in reducing gross to net scale are unusually large for hardwood, cypress, and turpentined pines, owing to the general prevalence in the past of forest fires, nonconservative turpentining practices, and the destructive agencies of wind, fungi, and insects; cull deductions range from 5 percent for slash pine to 20 percent for cypress, including allowance for sweep.

Cordwood Volumes[5/]

The total net volume of usable cordwood material with the bark in both sound and cull trees 5.0 inches and larger is more than 41 million standard cords (4 x 4 x 8 feet). It should be understood, however, that this includes volume that has also been considered in the sawtimber estimate given in the preceding section. In table 9 cordwood volumes are given for the important tree species-groups. "Upper stems of sawtimber trees" includes the usable volume from the upper limit of the sawlogs to a variable minimum-diameter limit, which is not less than 4 inches inside bark but which varies with the quality. For hardwoods and cypress, limbs are included to a 4-inch minimum diameter. In the volume of "Sound trees under sawlog size," the full stems only (without limbs) are included for all species up to a variable diameter limit but not less than 4 inches. Under "Cull trees," only the usable sound portion in such trees is included. As previously stated, all volume figures are net, deductions having been made for woods cull — the material unsuitable for use because of fire scar, rot, or other defects. For the sound trees, the deductions averaged 5 percent, varying from 1 percent for second-growth slash and longleaf to 15 percent for cypress. The deductions for cull trees varied from 20 to 80 percent of their gross volume.

Pulpwood and fuel wood are the principal uses for cordwood material. While most species are useful for fuel wood, in this locality only the pines are used at present for pulpwood, although cypress and the soft-textured hardwoods, such as the gums, magnolia, bay, maple, etc., are suitable for certain types of pulping. Only half of the total pulpwood inventory of almost 34 million cords is in pine; most of the remainder is in pulping hardwoods.

5/ For more detailed information, see "Pulping and nonpulping cordwood volume in Survey Unit #2, Florida," Forest Survey Release #19, Apr. 30, 1936, Southern For. Exp. Sta., New Orleans, La.

Table 9. -- Net volume of all sound material, expressed in cords

Tree species-group	Source of material				Total
	Sawtimber trees		Sound trees under saw-log size	Cull trees	
	Sawlog portion	Upper stems			
	Cords				
Pulping species:					
Pines:					
Turpentine (round	2,776,400	557,600	2,996,100	30,400	6,360,500
pines (turpentined	3,688,300	1,256,000	1,330,700	56,800	6,331,800
Loblolly and other pines	2,708,500	503,400	709,300	190,100	4,111,300
Total pines	9,173,200	2,317,000	5,036,100	277,300	16,803,600
Hardwoods (pulping)	3,786,600[1/]	1,946,800	5,296,300	2,840,300	13,870,000
Cypress	1,505,800[1/]	500,100	642,500	562,100	3,210,500
Total pulping species	14,465,600	4,763,900	10,974,900	3,679,700	33,884,100
Nonpulping hardwoods	1,897,500[1/]	1,072,900	1,934,700	2,329,500	7,234,600
Total all species	16,363,100	5,836,800	12,909,600	6,009,200	41,118,700

1/ Usable limbs included.

Relative stands per acre in cords for the various forest conditions and type-groups, as found by dividing total volumes by the respective areas, are given in table 10.

Table 10. -- Average cordwood volumes per acre of good trees, including bark [1/]

Forest type-group	Old growth		Second growth			All conditions [2/]
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size	
	Cords					
Longleaf and slash pines	13.1	8.3	9.8	7.6	2.3	3.5
Loblolly and other pines	20.6	12.6	16.2	11.6	3.5	9.7
Hardwoods	22.2	16.8	17.2	10.2	2.0	7.9
Cypress	18.9	16.9	18.0	11.9	7.8	14.6
All types (weighted averages)	17.9	12.8	12.0	9.3	2.3	5.2

1/ For additional information see "Volumes on Average Acres in the Principal Units of the Naval-Stores Region," Forest Survey Release #29, Oct. 30, 1937, Southern For. Exp. Sta., New Orleans, La. Upper stems and limbs of sawlog-size hardwoods and cypress are not included.

2/ Includes areas of reproduction and clear-cut forest conditions.

The growing stock of all species, made up of sound trees only (upper stems and limbs of sawlog-size hardwoods and cypress, and cull trees excluded), contains 13 million cords in sound trees under sawlog size and 19 million cords in sawtimber trees. The competitive demand for sawtimber, and the present larger stumpage value for naval stores, lumber, poles, and piles, indicate the desirability of holding a considerable part of the smaller sound trees for such future use. There are, however, nearly 4 million cords of pulpwood in cull trees, over 6 million cords in trees that have been or are now being worked for turpentine, about 300,000 cords available annually from tops of sawtimber trees cut, and a large undetermined volume of wood that may be salvaged in thinning over-dense stands of young timber, all of which, if used as fully as possible, should reduce the utilization for cordwood of sawtimber trees both actual and potential. A market for pulpwood and fuel wood provides excellent outlets for forest improvement cuttings. The cordwood volume of the various size-classes of trees (cull trees only excluded) is shown graphically in figure 8.

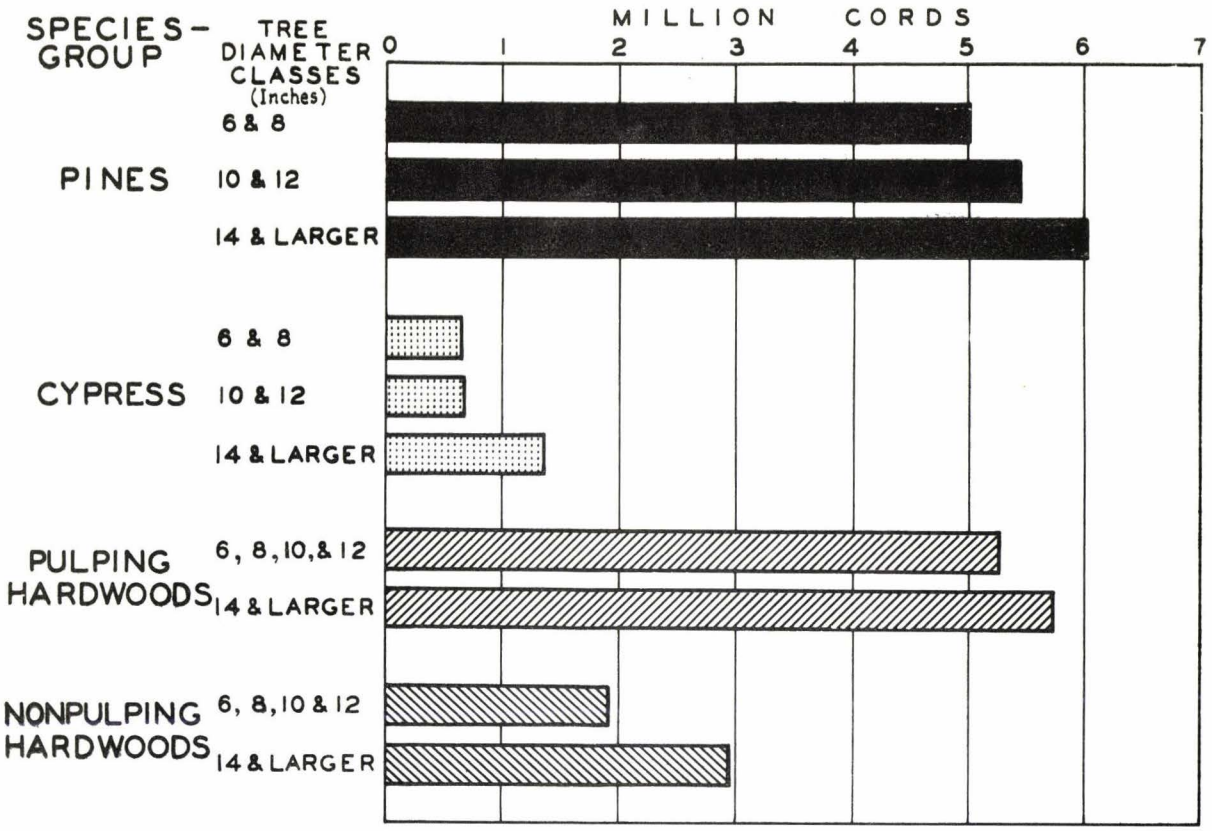

FIGURE 8 - CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES BY SIZE-CLASSES, SOUND TREES ONLY.

Poles and Piles[6/]

A special inventory was made of poles and piles, based upon the specifications of the American Standards Association, and the resulting estimate of 14½ million pine trees suitable for these uses (table 11) is believed to be conservative. These trees, which have been included in the volume inventories previously given, are scattered throughout the unit, singly or in groups; although found in many forest types, they occur most commonly in the longleaf-slash pine areas. Approximately 63 percent of the poles and piles are in trees 7.0 to 10.9 inches d.b.h., 32 percent are in trees 11.0 to 14.9 inches, and only 5 percent are in trees 15.0 inches or larger. Approximately 94 percent of the trees classed as potential poles or piles will yield sticks 20 to 35 feet long.

6/ For additional information and for comparison with other units, see "Pole and pile timber in four Southeastern Survey Units," Forest Survey Release #21, Aug. 29, 1936, Southern For. Exp. Sta., New Orleans, La.

Table 11. -- Pole and pile resources

Species-group	Length of poles and piles			Total	Percent of total
	20 and 25 feet	30 and 35 feet	40 feet and over		
	- - - - - - Thousand sticks - - - - - -				
Round longleaf and slash pines	5,381	1,753	411	7,545	52.0
Turpentined longleaf and slash pines	3,789	1,439	415	5,643	38.9
Other pines	997	324	-	1,321	9.1
Total	10,167	3,516	826	14,509	100.0
Percent of total	70.1	24.2	5.7	100.0	

Increment

In 1935 the net sawtimber increment of the growing stock of 7 billion board feet of sound trees of all species amounted to 214 million board feet green lumber tally, as measured by the International $\frac{1}{4}$-inch kerf rule (table 12). This does not mean, however, that the sawtimber growing stock showed a net increase of this amount as a result of the year's growth; as a matter of fact, the volume of the sawtimber cut was in excess of the increment. The actual growth due to the increase in volume of the sawlog-size trees in the stand, plus that added by the recruitment of new trees from the smaller sizes, amounted to 353 million board feet; deducting the mortality figure, 139 million board feet, leaves the net increment as stated.

Table 12. -- Total net sawtimber increment classified according to forest condition and species-group, 1935

Forest condition	Species-group				Total all species-groups
	Longleaf and slash pines	Loblolly and other pines	Hardwoods	Cypress	
	- - Thousand board feet (green lumber tally) - -				
Old growth	20,900	1,900	54,600	6,400	42,000
Second growth:					
Sawlog size	38,200	35,100	17,000	2,900	93,200
Under sawlog size	59,100	10,200	6,900	700	76,900
Reproduction and clear-cut	1,600	300	(1/)	(1/)	1,900
Total	78,000	47,500	78,500	10,000	214,000

1/ Negligible.

Almost 60 percent of the net sawtimber increment is pine; hardwood makes up most of the remainder, as cypress grows very slowly. Old-growth forest conditions, containing over half of the sawtimber growing stock, all species combined, produces only 20 percent of the net increment. In fact, old-growth longleaf and slash pines, both round and turpentined, show a negative net increment. Second growth, with less than half of the growing stock, produces 80 percent of the net increment.

Measured in terms of cordwood, in 1935 the net increment of all sound trees 5 inches d.b.h. and larger amounted to 882,000 cords of rough wood, or 60 million cubic feet of wood inside bark (table 13). Neither the volume in cull trees nor that in the upper stems and limbs of sawlog-size hardwoods and cypress is considered part of the growing stock.

Table 13. -- Net increment, 1935

Forest condition	Net regional increment			Average increment per acre		
	M bd. ft. 1/	Cords 2/	M cu. ft. 3/	Bd.ft. 1/	Cords 2/	Cu.ft. 3/
Old growth	42,000	171,800	10,840	42	.17	11
Second growth:						
Sawlog size	93,200	337,900	23,960	104	.38	27
Under sawlog size	76,900	371,000	25,460	30	.15	10
Reproduction and clear-cut	1,900	1,600	70	1	(4/)	(4/)
Total	214,000	882,300	60,330	36	.15	10

1/ Green lumber tally. 2/ Rough wood, including bark.
3/ Inside bark (i.b.). 4/ Negligible.

Although low net-increment per-acre figures are characteristic of this Survey unit, they vary considerably (table 13), with the greatest in the sawlog-size second-growth stands. The per-acre net increment in 1935 for the entire forest area (i.e., clear-cut and reproduction areas included) was only 36 board feet of sawtimber, or a trifle over 1/7 cord of all material.

With natural conditions, such as climate, species, etc., generally favorable to growth, the net-increment figure for the entire forest is strikingly low. This is explained largely by the facts that the mortality is high; the forest stands are thinly stocked; the proportion of idle or clear-cut forest land is unusually high; and the growth rate of the individual trees has been slowed down by periodically recurring fires and by turpentining. Harsh measures of turpentining, such as chipping too deeply, over-cupping the small trees, and burning the crop acreage, which have been practiced for years in many of the turpentine stands, have reduced their annual sawtimber increment by possibly more than 100 million board feet.

Wood-Products Industries

The lumber industry became active in this Survey unit coincident with the rapid railroad expansion that began in 1870, and the naval-stores industry followed about 1900. Today these industries enjoy excellent transportation facilities, including railroads (the Louisville and Nashville, the Seaboard Air Line, the Atlantic Coast Line, the St. Louis and San Francisco, and several short connecting lines); numerous highways and country roads traversing the unit; and water transportation on the Gulf, the Intracoastal Waterway, and the Apalachicola, Choctawhatchee, and other rivers.

The most important wood-using industry is lumber, as witnessed by the more than 200 sawmills within the unit (table 14). Although about four-fifths of the mills have a daily capacity of less than 20 M board feet, it is significant that only 28 percent of the 290 million board feet of lumber produced was cut by these mills, while 27 percent was cut by mills with a daily capacity of 20 to 39 M board feet, and 45 percent by mills with a capacity of at least 40 M board feet per day. Furthermore, it is noteworthy that the large sawmills, chiefly dependent upon extensive blocks of old-growth timber, are slowly cutting out and that the trend is decidedly towards small, mobile equipment, which can utilize more efficiently the light second-growth stands. In 1936 the sawmills, as a whole, operated at less than half their annual capacity, an indication of the relatively unfavorable condition of the lumber markets.

Table 14. -- Number of sawmills, amount of lumber cut, and man-days of employment, in mills of various sizes, 1936

Daily (10 hrs.) rated capacity in M board feet	Number of sawmills	Lumber cut				Employment
		Pine	Hardwood	Cypress	Total	
		Thousand board feet				Thousand man-days
Under 20	176	74,100	4,100	4,100	82,300	249
20 - 39	19	66,600	9,100	2,800	78,500	256
40 - 79	8	38,700	27,900	3,500	70,100	247
80 and over	3	53,900	3,600	1,900	59,400	155
Total	206	233,300	44,700	12,300	290,300	907

In 1936, in addition to the large number of sawmills, there were over 60 other wood-products plants, ranging in size from tiny shingle mills to one of the largest kraft pulp and paper mills in the United States. The cooperage industry, with 7 plants largely engaged in the production of pine slack cooperage for rosin barrels, consumed almost 22 thousand cords (table 15). In making veneer, which was generally used for packages and boxes, four mills consumed over 14 million board feet. About 49 shingle mills, mostly very small establishments, were operating nearly always in cypress and for local consumption. While three small-dimension plants, one excelsior mill, and

one treating plant added to the diversification of the forest products, the kraft pulp and paper mill at Panama City was undoubtedly the most important single wood-utilization plant in this Survey unit. In 1936 it was the only pulp mill in northwest Florida, but in 1937 another large mill was nearing completion at Port St. Joe (Gulf County). Also the production of cross ties, poles and piles, fuel wood, and fence posts is important. While cross ties, poles, and piles were commercial products, most of the fuel wood and fence posts were produced by farmers for their own use. The total employment figure for all wood-using industries, 2 million man-days, which is equivalent to about 10,000 men regularly employed 200 days a year, is impressive, especially in consideration of the fact that the Census of 1930 reported a population in this Survey unit of 254,000, of whom only 96,000 were gainfully employed in all industries. The following table shows the amount of material produced by the industries in northwest Florida, the raw material for which was taken mostly from this Survey unit but partly from south Alabama, southwest Georgia, and northeast Florida. The labor shown is exclusively that employed in this Survey unit.

Table 15. -- Wood-products production and employment, 1936

Kind of plant or commodity	Units produced	Thousand man-days (10 hours) of employment		
		In woods	At plants	Total
Lumber	290,300,000 board feet	334	573	907
Veneer	14,100,000 board feet	30	19	49
Cross ties	318,000 pieces	43	-	43
Poles and piles	62,000 pieces	13	-	13
Fence posts	879,000 pieces	14	-	14
Cooperage	21,700 cords	22	26	48
Fuel wood	368,000 cords	446	-	446
Miscellaneous (pulp mills, shingle mills, treating plants, 1/ etc.)	356,400 cords	239	340	579
Total		1,141	958	2,099

1/ For the treating-plant, only labor at the plant is included.

Commodity Drain from the Growing Stock

The manufacture of forest products in 1936 caused a drain upon the sawtimber growing stock of the Survey unit of 415 million board feet, or upon all sound trees at least 5 inches d.b.h. of 85 million cubic feet (table 16). This commodity drain, as distinguished from the drain caused by mortality within the stands, is the 1936 cut, including the material cut for shipment to points outside the Survey unit and the waste incidental to the various logging operations. In the last column of table 16, the commodities derived as byproducts are charged to the primary use for which the

trees are felled; thus pulpwood obtained from the tops of trees cut for lumber is included under lumber drain.

Pine furnished 70 percent of the drain shown in board feet; hardwoods, 23 percent; and cypress, 7 percent. In spite of the greatly reduced area of old-growth stands, they were the source of about half the total commodity drain.

Table 16. -- Commodity drain from the sound-tree growing stock, 1936

Reason for drain	From sawtimber material				From all growing-stock material
	Species-group			Total	
	Pines	Hardwoods	Cypress		
	- - Thousand board feet (green lumber tally)- -				Thousand cubic feet (i.b.)
Lumber	187,400	50,000	16,100	253,500	46,220
Cross ties	7,300	500	8,800	16,600	2,900
Poles and piles	6,300	-	200	6,500	1,260
Veneer	8,600	8,100	-	16,700	2,690
Cooperage	5,700	4,200	-	9,900	1,990
Fuel wood	25,500	32,800	-	58,300	12,450
Fence posts	-	-	-	-	130
Miscellaneous 1/	50,800	400	2,500	53,700	17,360
Total	291,600	96,000	27,600	415,200	85,000

1/ Includes domestic farm use, pulpwood, and land clearing.

Neither cull trees, dead trees, nor the upper stems and limbs of hardwood and cypress are included in the sound-tree growing stock for which growth is calculated, and no material cut from these sources is included in table 16. It is estimated that in 1936 the drain from this material was as follows:

1.	Cut from the tops and limbs of sawlog-size hardwood and cypress trees	120,000 cords
2.	Cut from cull trees	66,000 cords
3.	Fuel wood cut from dead trees	142,000 cords
4.	Fence posts cut from dead trees	5,000 cords
	Total 7/	333,000 cords

It is significant that cull trees furnished only 4 percent of the total commodity drain from live trees, although they contain 15 percent of the volume in all sound material, as shown in table 9. While little progress has yet been made in ridding the forest of these undesirable trees, a growing market for pulpwood should offer greater opportunity for their removal.

7/ In addition, 123,300 tons of stumps were used in 1936.

Comparison of Increment and Drain

Inventory data on volumes given in previous tables are based upon field work in 1934. Additions produced by growth and deductions caused by mortality and commodity drain indicate that in the 3 following years the sawtimber growing stock has been reduced 2 to 3 percent per year, as shown in table 17.

Table 17. -- Changes in the growing stock

Date	Sawtimber material				All growing-stock
	Species-group			Total	
	Pines	Hardwoods	Cypress		
	- - Thousand board feet (green lumber tally) - -				Thousand cubic feet (i.b.)
Jan. 1, 1934	4,089,200	2,289,900	629,900	7,009,000	2,250,630
Jan. 1, 1935	3,982,600	2,261,800	623,500	6,867,900	2,234,260
Jan. 1, 1936	3,865,200	2,212,500	615,000	6,692,700	2,217,040
Jan. 1, 1937	3,722,400	2,195,200	597,200	6,514,800	2,190,630

As with a bank deposit, the growing stock cannot be maintained intact if the withdrawals (mortality and commodity drain in the forest) exceed the interest (forest growth). In 1936, in the combined uncut and partly cut old-growth conditions, the commodity drain was more than four times the net sawtimber increment; and it is evident that many of the large plants that depend upon old-growth timber, e.g., the big sawmills, will be forced to shut down or adapt their operations to second growth. The rapidly expanding demand for pulpwood fortunately can be met from the relatively fast-growing second-growth stands. There is, however, no chance of meeting all industrial sawtimber requirements from the increment from second growth, for the drain in 1936 from second growth equals or exceeds the increment.

In the trees in the growing stock 5 inches d.b.h. and larger, including those of sawlog size, the cubic-foot commodity drain is 1.5 times as great as the net increment (table 18). The excess of drain over increment is greater proportionally in the pines and cypress than in the hardwoods (fig. 9).

Deficiencies in the Present Forest

The principal deficiencies in the present forest, as shown by figure 3 are: (1) the distribution of age-classes by area is unsatisfactory; and (2) the stocking is sadly deficient. After years of harvesting of the larger and more valuable trees in the growing stock, the remaining stands are composed chiefly of small trees 2 to 12 inches d.b.h., as shown in figure 2. These small trees, because of widespread fires, harsh measures of turpentining, and the normal causes of death, have a high mortality rate.

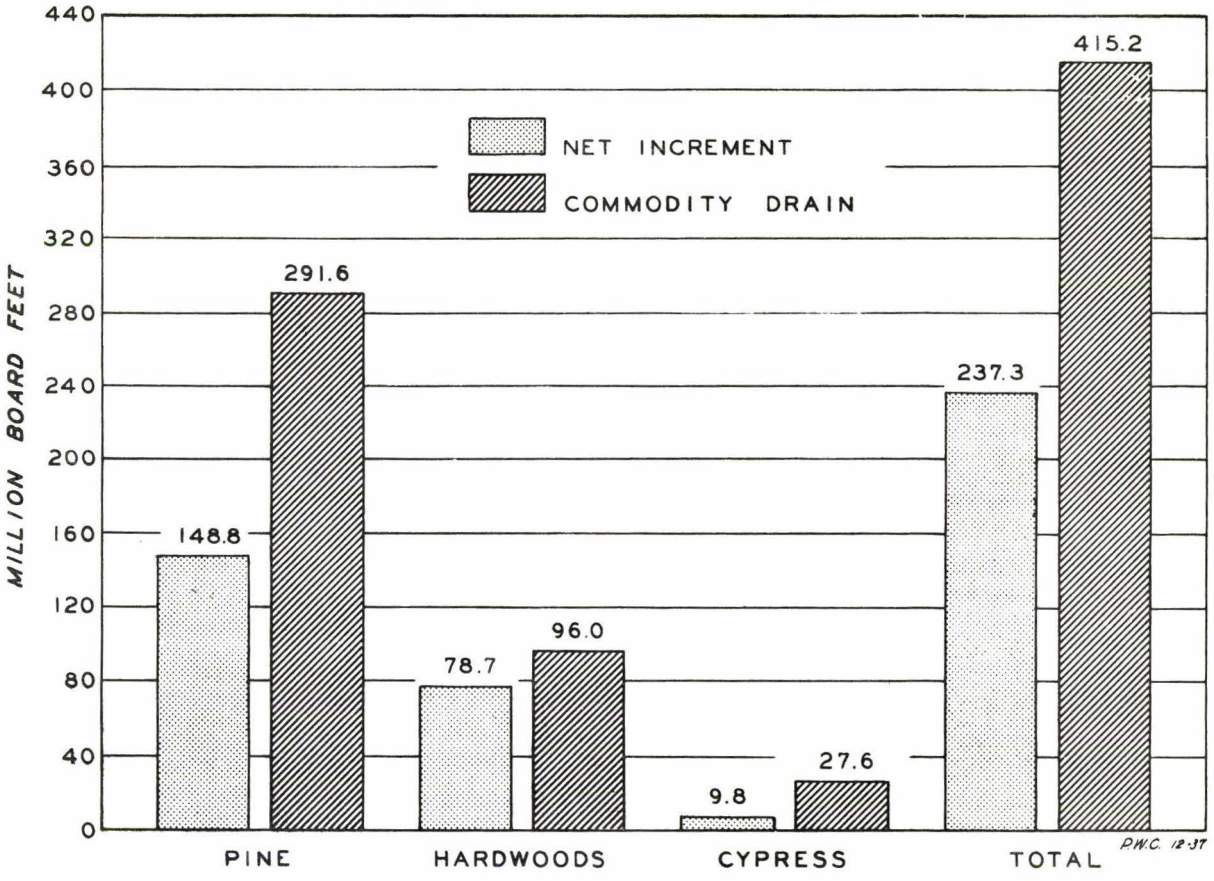

FIGURE 9.- COMPARISON OF NET INCREMENT OF SAWLOG-SIZE TREES WITH THE COMMODITY DRAIN, 1936.

In its present deteriorated condition, therefore, the growing stock with its annual increment composes a mere fraction of the productive capacity of the sites; the present average net increment per acre is only 36 board feet of sawtimber, or 1/7 of a cord of all sound-tree usable material. The presence of a large acreage of clear-cut forest land and of forest lands possessed by scrub oak is partly accountable for the low increment per acre.

Fire is the most important factor militating against the development of well-stocked stands. Uncontrolled forest fires have for years swept through the woods, killing the small trees that are needed as recruits for the growing stock, as well as injuring or killing some of the larger trees. While many of the fires originate from carelessness, the great majority are purposely and systematically set.

Summary of Present Situation and Outlook for the Future

The Forest in the Economic Picture

In Northwest Florida 4 acres out of 5 (average) are in forest use (table 1). The Census figures for the last 15 years show no increase in use of lands for agriculture, and the Unemployment Census taken November 16-20,

Table 18. -- Comparison of increment with commodity drain in board feet and cubic feet, 1936

Item	Sawtimber material				All growing-stock
	Species-group			Total	
	Pines	Hardwoods	Cypress		
	-- Thousand board feet (green lumber tally) --				Thousand cubic feet (i.b.)
Growing stock, Jan. 1, 1936	3,865,200	2,212,500	615,000	6,692,700	2,217,040
Growth	257,900	97,200	13,800	368,900	99,660
Mortality	109,100	18,500	4,000	131,600	41,070
Net increment	148,800	78,700	9,800	237,300	58,590
Commodity drain	291,600	96,000	27,600	415,200	85,000
Net change in growing stock	-142,800	-17,300	-17,800	-177,900	-26,410
Growing stock, Jan. 1, 1937	3,722,400	2,195,200	597,200	6,514,800	2,190,630

1937, classes almost 13,000 people as unemployed and wanting work. The region was largely developed around its forest resource, upon which it has always leaned heavily for employment and income. It has a well-developed group of forest-using industries, including more than 100 turpentine stills, over 200 sawmills, 2 large pulp mills, and more than 60 other wood-using plants. The future security and opportunity for expansion of these industries is a matter of outstanding importance and concern to every part of the unit. An examination and analysis of the forest stand and its present productivity give strong grounds for the belief that the forest resource has been so depreciated that only organized, intensive, and concerted action on the part of timber owners, forest industries, and public agencies can assure an optimistic future. Although the forest situation is far from satisfactory, it is not too late for remedial action.

Measures for Improvement

Some of the land owners are receiving assistance in the protection of their lands from fire through the cooperative fire-protection sections of the Clarke-McNary Law. Progress has been made in recent years, and now about one-fifth of the privately owned forest land is under organized fire protection, which should be extended to all forest lands in the unit.

On about 200,000 acres of clear-cut land on which no seed trees exist, artificial reforestation must be resorted to, if the area is to be restocked within a reasonable time. The Florida Forest Service has cooperated with private individuals in making many demonstration plantings, which indicate that the possibilities of artificial reforestation are good if the work is done carefully and is confined to the better sites. On 675,000 acres of clear-cut land, pine seed trees are present, and under continued protection from fire a large part of this area may be expected to restock naturally to pine. A half million acres of land formerly in pine, but now occupied by scrub oak, will require many years to restock to pine if left to the slow processes of nature. It is unlikely that economic conditions will warrant the planting of much of this scrub oak area, owing to its low productivity. It may be that private enterprise cannot be expected to reforest artificially the large blocks of clear-cut and scrub oak lands, and that either the State or the Federal Government should undertake the task in the public interest. The area of land needing planting, however, should not increase; in fact, it should decrease if better fire protection and better cutting practices are maintained.

Turpentining in the old manner has been responsible for many of the deficiencies in the pine stands. A widespread adoption of the conservation practices now used by the more progressive naval stores operators would greatly reduce the harmful effect of turpentine operations on growth and mortality and should increase directly the yields both of naval stores and of wood products.

The accumulation of worked-out turpentine trees, no longer of value to the naval stores operator and rapidly deteriorating in value for wood products, should be removed from the stands in the form of pulpwood, poles, ties, and lumber. There are about 2 million cords of this material now on hand in the trees of the unit, which, in addition to representing an economic waste, are retarding the development of new trees on the areas occupied. Furthermore, there are 6 million cords of wood in cull trees of all species (mainly hardwoods and cypress) that also should be removed from the stands to supplement the wood supply as well as to improve the growing conditions. A large amount of wood in the tops, stems, and limbs of trees is left in the woods to rot when the trees are cut; a more complete utilization of this material for pulp and fuel wood not only would help the supply situation but also would reduce the fire hazard in cut-over stands.

Close and profitable utilization of the wood supply will depend largely upon a careful integration of the demands for the many and varied forest industries. The lumber, veneer, pole and piling, and similar industries, depend, by the nature of their products, upon high-quality stumpage; while the demands of the pulpwood, fence post, and fuel wood industries can be met from either high- or low-quality trees.

Land owners in their own interest should recognize quality grades in their trees and should sell or cut them for the commodities that yield the greatest stumpage returns. The several wood-using industries that depend on open-market purchases of stumpage will conserve the forest resource by using for their commodities only those trees that do not have a higher stumpage value for other uses.

State and county tax authorities should recognize that long-time forest management, often involving deferred returns, must have sympathetic tax treatment. A stable policy of reasonable annual taxes, based upon sliding-scale valuations that adjust payments to earning power and periods of cropping, is essential. The Forest Taxation Inquiry authorized by Congress to study such problems has recommended several tax plans with this principle in view.

The material improvement of the forest situation will require the general application of the measures here cited. Since the forest resource is not, and never will be, all under one ownership or management but, on the contrary, is owned and used by thousands of individuals with all kinds of limitations, policies, and objectives of management, the problem of obtaining a widespread acceptance and application of these essential forestry measures will require time and organized action. One obvious way to accomplish this task, slow though it may be, is by educating land owners, wood consumers, turpentine operators, taxing authorities, newspaper editors, and the general public to realize the value of these measures and to understand their application in practice. Specifically, the educational effort required might be exerted by greatly extending and integrating the activities of existing public and quasi-public agencies, including the Extension Services and Forest Services of the State and Federal Governments, the forestry departments of wood-using industries and railroads, and the forestry instruction in the public schools and colleges.

Outlook for the Future

The naval-stores industry has a sufficient supply of round turpentine timber in sight to maintain production of gum, rosin, and turpentine at present levels for many years to come, perhaps indefinitely, provided that this supply is not reduced materially through increased cutting of round trees for pulp mills and sawmills.

The wood-using industries, including those of lumber, pulp, poles, ties, and veneer, are not so secure. The supply of old-growth timber from which high-grade lumber must come, is decidedly limited, and industries depending upon it are confronted in general with a dwindling supply that is not being replenished. The industries that can use low-grade material or small trees are in no immediate danger of shortage, particularly if they use a larger part of the available forest waste previously referred to, but the combined cut for all industries is at present in excess of the annual increment on the growing stock; if this is continued without any ameliorating action, there must inevitably result a progressive reduction of the growing stock and a consequent lowering of the contribution that the forest resource can make to the general welfare of the region.

Northwest Florida should anticipate an improvement in its present social and economic conditions, but to the extent that it must depend upon its forest resource to accomplish this worthwhile objective, the present balance of increment and drain does not justify optimism. It is entirely possible, however, to build up this resource by fire protection, planting, improvement cuttings, and more conservative methods of turpentining and logging. With a highly-developed forest resource, old industries can be expanded and new industries brought in, landowners can realize more on their forest investments, and the entire area can feel the stimulation of more and larger payrolls with their attendant increase in buying power and security.